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A SUMMARY OF DWARF MISTLETOE
PROGRAM ACTIVITIES IN THE
ROCKY MOUNTAIN REGION--1970-1986

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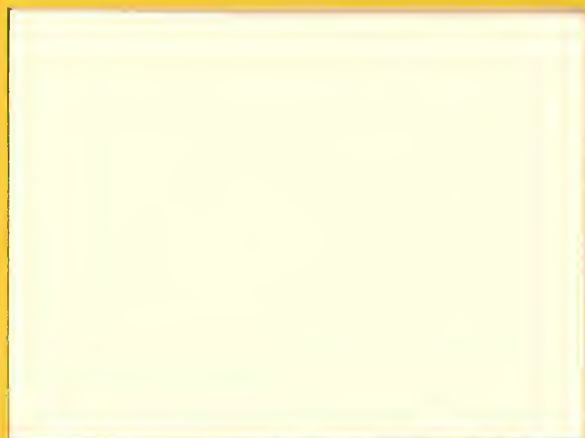
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Timber, Forest Pest, and
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A SUMMARY OF DWARF MISTLETOE PROGRAM ACTIVITIES
IN THE ROCKY MOUNTAIN REGION--1970-1986

Scope of the Dwarf Mistletoe Problem

Dwarf mistletoes, Arceuthobium species, are the most damaging disease agents of conifers in the western United States. Annual growth loss and mortality from these parasitic plants has been estimated at over 393 million cubic feet. Although several species of Arceuthobium are present in the Rocky Mountain Region (Table 1), only A. americanum (lodgepole pine dwarf mistletoe and A. vaginatum subspecies cryptopodum (Southwestern dwarf mistletoe) are considered to be of management concern. In some areas A. douglasii (Douglas-fir dwarf mistletoe) is important. Maps that show the distribution of the species in the Region are presented in Figure 1. Estimates of the percentage and acreage of lodgepole pine and ponderosa pine type infested by Forest are presented in Table 2. Combined merchantable losses to these mistletoes is estimated at over 10 million cubic feet annually for National Forest lands alone in this Region.

Table 1: Principal hosts and general distribution of dwarf mistletoe species in the Rocky Mountain Region

<u>Dwarf mistletoe species</u>	<u>Principal hosts</u>	<u>Distribution</u>
<u>Arceuthobium americanum</u>	Lodgepole pine; occasional cross- over to ponderosa pine	Colo., Wyo.
<u>A. cyanocarpum</u>	Limber pine, white bark pine	Colo., Wyo.
<u>A. divaricatum</u>	Pinyon	W. Wyo.
<u>A. douglasii</u>	Douglas-fir	Colo., W. Wyo.
<u>A. vaginatum</u> subsp. <u>cryptopodum</u>	Ponderosa pine	Colo.



Figure 1. Distribution of Arceuthobium species in Region 2.

Table 2: Incidence of Arceuthobium americanum and A. vaginatum subsp. cryptopodum in Rocky Mountain National Forests

National Forest	<u>A. americanum</u> Acres Infested		<u>A. vaginatum</u> Acres Infested	
	%	No.	%	No.
<u>Colorado</u>				
Arapaho/Roosevelt	48	220,900	19	18,100
Grand Mesa/Uncompahgre and Gunnison	52	77,200	4	3,000
Pike and San Isabel	43	76,600	20	53,400
Rio Grande	0	0	<u>1/</u>	<u>1/</u>
Routt	52	90,500	0	0
San Juan	0	0	21	45,500
White River	36	52,200	0	0
<u>Wyoming</u>				
Bighorn	36	51,000	0	0
Medicine Bow	60	193,000	0	0
Shoshone	64	81,000	0	0
Totals	49	842,400	16	120,000

1/ This dwarf mistletoe occurs in the Forest, but was not recorded in surveys.

Dwarf Mistletoe Program Emphasis and Benefits

The emphasis of the program in the Region has been on locating and defining those management units where infected non-merchantable overstory trees were left standing in older timber sales and pose a threat to established regeneration. In many cases these young stands will not reach merchantable size if the infected residual trees are not felled or removed.

The dwarf mistletoes are most easily and economically treated by silvicultural practices. Several features of these parasites make them ideal candidates for cultural treatment:

- The dwarf mistletoes are obligate parasites; that is they require a living host to survive. Once an infected tree or branch is cut, the mistletoe dies. There is no need to destroy the slash.
- They are generally host specific; that is they are usually confined to a single host species or group of closely related species. Immune or resistant species can be favored during stand treatments.
- Their life cycles are relatively longer than other tree disease organisms. The development of mature mistletoe plants from seeds takes two to eight years. From a practical standpoint, these long life cycles mean that the amount of infection increases relatively slowly. If a stand is properly treated, dwarf mistletoe should not be a problem in subsequent rotations.
- Dwarf mistletoes spread slowly through stands. Seed dispersal is usually limited to less than 60 feet from a tall isolated tree. In even-aged stands, spread is even more limited averaging one to two feet per year.
- Infected trees and stands are easy to detect because of the presence of dwarf mistletoe plants, branch and stem swellings, and witches' brooms. Heavily infested stands show decline and mortality. Detailed surveys are an essential ingredient of successful control programs. Several survey methods have been developed to determine the distribution and intensity of infection. Whenever possible, surveys should be integrated into standard inventory procedures.

Presuppression surveys are utilized to define areas in need of treatment. Once the resource manager has located general problem areas and requested assistance from Forest Pest Management (FPM), plant pathologists schedule service trips to evaluate the biological need and effectiveness of proposed suppression projects. Forest stand yield simulation models, RMYLD, enable the manager to project the current forest stand with existing dwarf mistletoe infection levels and compare several treatments for effectiveness in reducing infection levels and increasing productivity of the stand. The priority of several stands for treatment can then be decided by comparing projections for each stand.

Other activities include the sanitation-thinning of lightly infested precommercial size stands and the replacement of severely infested stands by clear-cutting or prescribed burns.

Dwarf mistletoe suppression yields multiple benefits including:

1. Dwarf mistletoe infection delays the economic maturity of stands, adversely affecting wood quality and tree seed production. Dwarf mistletoe suppression is necessary to insure increased productivity of stands in the future to meet the increased demand for wood products.
2. Dwarf mistletoe suppression is necessary to protect other forestry investments, such as site preparation, tree planting, thinning and timber stand improvement. In addition, dwarf mistletoe control in infested stands prevents spread of the disease to adjacent healthy stands.
3. Dwarf mistletoe suppression results in increased productivity per acre and under intensive management results in reduced acreage needed to meet timber targets. In this manner we can concentrate harvesting activities on fewer acres at a reduced cost. With the trend of withdrawal of forest land from timber production and harvesting, it is imperative that we increase the productivity of the remaining commercial forest stands.
4. Dwarf mistletoe suppression reduces the susceptibility of stands to insect attack, particularly bark beetles, windthrow and natural fires.
5. The silvicultural procedures developed for dwarf mistletoe suppression have been proven to be very effective and provide control of the disease for the current and subsequent rotations.

Dwarf Mistletoe Program Expenditures and Accomplishments

Since 1970, the Rocky Mountain Region has surveyed over 266,000 acres and treated 32,000 acres at a cost of \$2.2 million (Table 3). A summary by National Forest is presented in Table 4. Detailed listings for each Forest by year are included in the Appendix (Tables 5-12). Expenditures have been rounded. These summaries only include projects in which FPM was directly involved. Many more acres of control were accomplished through timber harvests and other stand entries, however, we have no record of the acres treated. The FPM program consists of presuppression surveys, overstory removal, thinning and sanitation and stand replacement. Since 1980, the program has received greater support and emphasis. Five year planning documents have been prepared by several Forests and activities and funding requests have been integrated into the Forest planning and budgeting process. This strategy has insured a more continuous source of funding and program continuation than in the past, also resource managers can more effectively schedule time, resources and manpower.

Table 3: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments, Rocky Mountain Region--1970-1986.

Fiscal Year ^{1/}	FPM \$ ^{2/}	Acres Surveyed	Acres Treated
1970	-	-	639
1971	-	1,300	1,484
1972	-	4,000	1,376
1973	-	10,000	800
1974	-	25,000	-
1975	-	25,000	-
1978	-	9,000	262
1979	19,400	512	512
1980	69,600	27,306	693
1981	153,800	18,500	2,520
1982	226,500	47,197	4,278
1983 ^{3/}	745,400	11,825	6,268
1984	310,000	11,550	5,220
1985 ^{4/}	380,000	52,127	5,504
1986	<u>288,800</u>	<u>23,000</u>	<u>2,410</u>
Totals	2,193,500	266,317	31,966

^{1/} No program in 1976 or 1977.

^{2/} Records unavailable for years 1970-1978.

^{3/} Includes Jobs Bill funding.

^{4/} Includes TSI funding.

Table 4: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments Listed by National Forest, Rocky Mountain Region--1979-1986.

Forest	FPM \$ ^{1/}	Acres Surveyed	Acres Treated
Arapaho/Roosevelt	598,900	74,000	9,386
Grand Mesa/Uncompahgre/ Gunnison	219,600	17,693	2,702
Medicine Bow	502,400	17,700	7,970
Rio Grande	27,300	2,916	390
Routt	247,100	24,000	2,300
Pike/San Isabel	187,000	38,616	392
Shoshone	214,900	8,392	2,515
White River	<u>196,300</u>	<u>8,700</u>	<u>1,750</u>
Totals	2,193,500	192,017	27,405

^{1/} Includes Jobs Bill and TSI funds for years 1983, 1985.

Recommendations for the Future

Now that the backlog of overstory removal projects is completed, it is essential that future harvesting activity be directed at preventative measures for dwarf mistletoe control. It is much more efficient to prevent mistletoe from becoming established than to treat or replace severely infested stands. Suppression activities should be an integral part of good forest management and practiced as a part of normal stand management. Subsequently less reliance on FPM funds will occur in the future. Specific recommendations for future programs include:

1. Encourage Forests to complete site-specific dwarf mistletoe suppression plans based on existing presuppression survey data and other inventory data.
2. Insure that contract specifications for felling of non-merchantable infected trees be followed in timber sales.
3. Treat infested stands bordering sanitized stands. Prevent reinvasion of regenerated clearcuts from adjacent untreated stands.
4. Treat infested stands through planned sales, other stand entries whenever possible.
5. Emphasize control of the disease at final harvest and site preparation and ensure that infection is eliminated in regenerated stands.
6. Continue training programs that emphasize integration of pest management and good silviculture as the least-cost, most effective control of forest pests.

A complete chronological listing of service trips, biological evaluations and other technical reports on the dwarf mistletoe program for 1971 to 1985 are included in the Appendix.

APPENDIX

Table 5: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the Arapaho and Roosevelt National Forests (1980-86).

<u>Fiscal Year</u>	<u>FPM \$</u>	<u>Acres Surveyed</u>	<u>Acres Treated</u>
1980	8,700	2,600	186
1981	61,000	14,000	1,100
1982	111,900	31,100	3,685
1983 ^{1/}	- (238,000)	-	- (2,045)
1984	81,000	-	1,050
1985	48,300	26,300	820
1986	<u>50,000</u>	<u>-</u>	<u>500</u>
Totals	360,900 (238,000)	74,000	7,341 (2,045)

^{1/} Figures in parentheses funded by Jobs Bill.

Table 6: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the Grand Mesa, Uncompahgre and Gunnison National Forests (1980-86).

Fiscal Year	FPM \$	Acres Surveyed	Acres Treated
1980	9,000	17,106	-
1981	9,600	500	500
1982	20,000	87	187
1983 ^{1/}	10,000 (56,000)	-	115 (300)
1984	45,000	-	600
1985	35,000	-	500
1986	<u>35,000</u>	<u>-</u>	<u>500</u>
Totals	163,600 (56,000)	17,693	2,402 (300)

^{1/} Figures in parenthesis funded by Jobs Bill.

Table 7: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the Medicine Bow National Forest (1981-86).

Fiscal Year	FPM \$	Acres Surveyed	Acres Treated
1981	1,600	-	60
1982	33,200	12,000	-
1983 ^{1/}	41,400 (155,000)	-	726 (782)
1984	95,300	600	2,800
1985 ^{2/}	83,900 (65,600)	5,100	3,102
1986	<u>26,500</u>	<u>-</u>	<u>500</u>
Totals	281,900 (220,600)	17,700	7,188 (782)

^{1/} Figures in parentheses funded by Jobs Bill.
^{2/} Figures in parentheses funded by TSI.

Table 8: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the Rio Grande National Forest (1985-86).

<u>Fiscal Year</u>	<u>FPM \$</u>	<u>Acres Surveyed</u>	<u>Acres Treated</u>
1985 ^{1/}	2,800 (4,500)	916	- (90)
1986	<u>20,000</u>	<u>2,000</u>	<u>300</u>
Totals	22,800 (4,500)	2,916	300 (90)

^{1/} Figures in parentheses funded by TSI.

Table 9: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the Routt National Forest (1983-86).

Fiscal Year	FPM \$	Acres Surveyed	Acres Treated
1983 ^{1/}	5,000 (68,000)	2,000	- (680)
1984	51,700	8,000	520
1985	83,900	10,000	800
1986	<u>38,500</u>	<u>4,000</u>	<u>300</u>
Totals	179,100 (68,000)	24,000	1,620 (680)

^{1/} Figures in parentheses funded by Jobs Bill.

Table 10: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the Pike and San Isabel National Forests (1982-86).

Fiscal Year	FPM \$	Acres Surveyed	Acres Treated
1982	10,300	830	50
1983 ^{1/}	25,000 (10,000)	9,825	- (120)
1984	11,500	1,200	90
1985	34,900	9,761	12
1986	<u>95,300</u>	<u>17,000</u>	<u>120</u>
Totals	177,000 (10,000)	38,616	272 (120)

^{1/} Figures in parentheses funded by Jobs Bill.

Table 11: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the Shoshone National Forest (1979-86).

Fiscal Year	FPM \$	Acres Surveyed	Acres Treated
1979	19,400	512	512
1980	51,900	7,600	507
1981	65,700	-	860
1982	30,700	180	236
1983	14,000	-	200
1984	13,500	50	50
1985	7,700	50	50
1986	<u>12,000</u>	<u>-</u>	<u>100</u>
Totals	214,900	8,392	2,515

Table 12: Summary of Dwarf Mistletoe Program Expenditures and Accomplishments for the White River National Forest (1981-86).

<u>Fiscal Year</u>	<u>FPM \$</u>	<u>Acres Surveyed</u>	<u>Acres Treated</u>
1981	15,900	4,000	-
1982	20,400	3,000	120
1983 ^{1/}	- (123,000)	-	- (1,300)
1984	12,000	1,700	110
1985	13,500	-	130
1986	<u>11,500</u>	<u>-</u>	<u>90</u>
Totals	73,300 (123,000)	8,700	450 (1,300)

^{1/} Figures in parentheses funded by Jobs Bill.

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